CLAIMS

1. An avalanche photodiode comprsing:
an absorption layer disposed on a substrate layer;
a multiplication layer disposed on the substrate layer; and
a carbon-doped charge control layer disposed between the absorption layer and the multiplication layer.

2. The avalanche photodiode of claim 1 wherein the absorption layer is disposed between a first digital graded layer and a second digital graded layer.

3. The avalanche photodiode of claim 1 further comprising an n-type contact layer disposed between the multiplication layer and the substrate.

4. The avalanche photodiode of claim 1 further comprising a p-type contact layer.

5. The avalanche photodiode of claim 1 further comprising a buffer layer disposed between the n-type contact layer and the substrate.

6. The avalanche photodiode of claim 1 wherein the absorption layer is InGaAs.

7. The avalanche photodiode of claim 1 wherein the multiplication layer is InAlAs.

8. The avalanche photodiode of claim 1 wherein the carbon-doped charge control layer is carbon-doped InAlAs.

9. The avalanche photodiode of claim 1 wherein the carbon-doped charge control layer is between 2 and 100 angstroms in thickness.

10. The avalanche photodiode of claim 1 wherein the carbon-doped charge control layer is between 5 and 50 angstroms in thickness.

11. The avalanche photodiode of claim 1 wherein the carbon-doped charge control layer is between 5 and 35 angstroms in thickness.

12. The avalanche photodiode of claim 2 wherein the first digital graded layer is InAlGaAs, and further wherein the second digital graded layer is InAlGaAs.

13. The avalanche photodiode of claim 3 wherein the n-type contact layer is one of InP or InAlA.

14. The avalanche photodiode of claim 4 wherein the p-type contact layer is one of InP or InAlAs.

15. A method of fabricating an avalanche photodiode comprising the steps of:

providing a substrate layer;
depositing a multiplication layer;
depositing a carbon-doped charge control layer; and
depositing an absorption layer.

16. The method of claim 15 further comprising the step of depositing an n-type layer to collect electrons.

17. The method of claim 15 further comprising the step of depositing a p-type layer to collect holes.

18. The method of claim 15 further comprising the step of depositing a digital grading layer to prevent carrier trapping between bandgap offsets.

19. The method of claim 15 further comprising the step of doping an InAlAs material with carbon.